Claims

[001] Device for wet treatment of wafers comprising
a first plate
a second plate substantially parallel to said first plate
holding means for holding a wafer between said first and said second plate substantially parallel to said plates.
first dispensing means for introducing fluid into a first gap between said first plate and a wafer when being treated
second dispensing means for introducing fluid into a second gap between said second plate and a wafer when being treated
at least one vibrating element acoustically coupled to at least said second plate
rotating means for rotating said holding means and said second plate relative to each other about an axis substantially perpendicular to said second plate.

[002] Device according to claim 1 wherein said plates are substantially horizontally arranged.

[003] Device according to claim 1 wherein means for rotating at least one of said two plates.

[004] Device according to claim 1 wherein holding means and first plate are coupled to each other to form a holding unit.

[005] Device according to claim 1 wherein gripping means are provided for securely gripping a wafer.

[006] Device according to claim 1 wherein second plate is not rotatable.

[007] Device according to claim 1 wherein a liquid collector is circumferentially surrounding said holding means for collecting liquid that flows off a wafer during being treated with liquid.

[008] Device according to claim 1 wherein said second plate is sealed against said liquid collector.

[009] Device according to claim 1 further comprising means for varying distance from the first plate to the second plate to insert a wafer to the space defined between said two plates and to withdraw a wafer therefrom.

[010] Device according to claim 1 further comprising first spacer means for keeping the first plate and the holding means in certain distance during treating the wafer to form a gap between the wafer and the first plate of 0,1 mm to 10 mm preferably 0,5 mm to 5 mm during treating the wafer.

[011] Device according to claim 1 further comprising second spacer means for keeping the second plate and the holding means in certain distance during treating the wafer to form a gap between the wafer and the second plate of 0,1 mm to 10 mm

preferably 0,5 mm to 5 mm during treating the wafer.

[012] Device according to claim 1 wherein at least one of said at least one vibrating element is arranged with respect to the surface of the second plate facing the wafer so that ultrasonic waves are substantially directed to the wafer when treated taking an angle α' of 85° to 60° to the plane provided for the wafer.

[013] Device according to claim 1 further comprising additional gas dispenser for at least one of said first and second gap.

[014] Device according to claim 1 wherein an opening in at least one of said first or second plate does not include the rotational center.

[015] Device according to claim 1 wherein at least one vibrating element is arranged to cover the area of the rotational axis.

[016] Device according to claim 1 further comprising means for opening and closing holding elements of said holding means during treatment of the wafer.

[017] Device according to claim 1 wherein at least one plate at least partly comprises material having a specific sound-propagation velocity deferring not more to the specific sound-propagation velocity of water.

[018] Method for wet treating a single wafer comprising
holding a single wafer in a plane B
providing a first plate having a plane A facing the wafer thereby creating a first gap of a distance d1
providing a second plate having a plane C facing the wafer thereby creating a second gap of a distance d2
inserting a first liquid into said first gap thereby substantially completely filling said first gap
inserting a second liquid into said second gap thereby substantially completely filling said second gap
applying ultrasonic energy to said second plate while less than 10% of the ultrasonic energy applied to said second plate is applied to said first plate.
relatively rotating wafer and second plate against each other about a rotation axis substantially perpendicular to the wafer's main surfaces.

[019] Method according to claim 18 wherein the wafer is rotating.

[020] Method according to claim 18 wherein during term of processing substantially all parts of one wafer side are at least temporarily covered by the second plate.

[021] Method according to claim 18 wherein said second liquid is inserted into said second gap through an opening offset to the rotation axis.

[022] Device for wet treatment of wafers comprising
a first plate
holding means for holding a wafer in a certain distance substantially parallel to

said first plate.
first dispensing means for introducing fluid into a first gap between said first plate and a wafer when being treated
at least one vibrating element acoustically coupled to said first plate
rotating means for rotating said holding means and said first plate relative to each other about an axis substantially perpendicular to said second plate.
adjustment-elements are provided in order to direct ultrasonic waves at an angle α' of less than 89° to a wafer when treated.

[023] Device according to claim 22 wherein adjustment-elements comprise a slanted plane or slanted planes wherein at least one of said at least one transducers is placed.

[024] Device according to claim 23 wherein said at least one transducer placed in a slanted plane is acoustically coupled to an intermediate liquid chamber, said intermediate liquid chamber is further acoustically coupled to said first plate.

[025] Device according to claim 24 wherein said intermediate liquid chamber is connected to a liquid circuit.

[026] Device according to claim 22 wherein adjustment-elements comprise an array of a plurality of transducers with at least one ultrasonic generator to separately agitate said plurality of transducers in a phase-shifted way in order to generate an ultrasonic wave directed from said array of transducers at an angle α' of less than 89°.

[027] Device according to claim 26 wherein said array of transducers is a two dimensionally arranged plurality of transducers.

[028] Device according to claim 26 wherein the quotient of the distance a of the first plate to the wafer surface facing said first plate and the mean distance d between the centers of two adjacent transducers of the array is greater than 5 ($a/d>5$).

[029] Device according to claim 26 wherein the mean distance d between the centers of two adjacent transducers of the array is smaller than 2 mm.

[030] Device according to claim 26 wherein the width D of the array of transducers is at least three times as big as the distance d1 of the first plate to the wafer surface facing said first plate ($D \geq 3*d1$).

[031] Device according to claim 22 a second plate substantially parallel to said first plate and second dispensing means for introducing fluid into a second gap between said second plate and a wafer when being treated.

[032] Method for wet treating a single wafer comprising
holding a single wafer in a plane B
providing a first plate having a plane A facing the wafer thereby creating a first gap of a distance d1

inserting a first liquid into said first gap thereby substantially completely filling said first gap

applying ultrasonic energy to said first plate so that ultrasonic energy is applied to said plane B in an angle α' of less than 89°

relatively moving wafer and first plate against each other along a direction substantially parallel to the wafer's main surfaces

[033] Method according to claim 32 wherein said relative movement of wafer and first plate against each other along a direction substantially parallel to the wafer's main surfaces is carried out by relatively rotating wafer and second plate against each other about a rotation axis substantially perpendicular to the wafer's main surfaces.

[034] Method for wet treating a single wafer according to claim 32 further comprising providing a second plate having a plane C facing the wafer thereby creating a second gap of a distance d2

inserting a second liquid into said second gap thereby substantially completely filling said second gap.

[035] Method according to claim 32 wherein during term of processing substantially all parts of one wafer side are at least temporarily covered by the second plate.

[036] Method according to claim 32 wherein said ultrasonic energy applied to said first plate so that ultrasonic energy is applied to said plane B in an angle α' of less than 89° is generated an array of a plurality of transducers with at least one ultrasonic generator to separately agitate said plurality of transducers in a phase-shifted way in order to generate an ultrasonic wave directed from said array of transducers at an angle α' of less than 89°.

[037] Method according to claim 32 wherein angle α' is varied during the wafer being treated with liquid.